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ABSTRACT

The study of knowledge production and utilization deals with the problems of how to translate theoretical concepts and knowledge into practical solutions to people's problems. Many criticisms have been leveled at aspects of previous information system models, including their linearity, one-way communication paths, overdependence on scientific knowledge, and lack of interactive communication. The six-stage model proposed here attempts to correct these problems. In the scientific knowledge production stage, basic and applied research are carried out. In the knowledge management stage, the resulting findings are monitored, screened, indexed, catalogued, packaged, and stored. In the knowledge translation stage, "linkers" translate the available knowledge into terms applicable to the clients' formulation of their problems. The product development stage contains the development of products having the potential to meet user needs. These products are then distributed to users in the product dissemination stage. In the product adoption and utilization stage, the users adapt and effectively utilize the solution. Although this six-stage model may appear one-way linear, a look at a concrete example of its functioning shows that it is not. Needs can be communicated from users back through disseminators and developers to the knowledge production stage, and interaction may occur between many of the stages. (Author/JM)

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KNOWLEDGE PRODUCTION AND UTILIZATION*

by

George M. Beal and Peter Meehan**

Rural sociologists have often been defined, and usually prided themselves, as being practical sociologists, interested in real world problems and solutions, and concerned with and often involved in research utilization--the "original" applied sociologists. One main research tradition has been adoption-diffusion--the study of how modern information and technology is communicated, adopted and diffused. Many, especially Extension sociologists, have wrestled with the problems of how to translate sociological concepts and knowledge into practical solutions to people's problems.

Most of those engaged in these thoughts and actions must have in their mind some image of an information-communication system. It probably includes ideas such as, generated or available information, formed into messages, disseminated through channels to target or user audiences. These images may be very clearly defined and articulated in some generally accepted and shared model or they may be a very experiential and personalized "style" of communication dissemination or action. Nevertheless, the image is based on some implicit or explicit image of an information system.

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Historically relatively simple information system models have been used, such as, research-linking-client systems (Rogers and Jain, 1969). A number of criticisms have been leveled at the various explicit and implicit information system models extant. Among those criticisms are (1) the assumption of linearity, knowledge flowing only from research, through technology to users (Gideonse, 1968) (Guba and Clark, 1975), (2) the major assumption of one way communication "down" through the system, largely authoritarian, persuasive or manipulative (Schutjer and Van Der Neen, 1976) (Wharton, 1969) (O'Kelley, 1977) (Cummings, 1977), (3) based on the above points the perception of the creation of dependency (rather than collaborative) relationships (Schumacher, 1973) (Roling, 1973) (Cummings, 1977) (Darling, 1977), (4) the assumption that only scientific research knowledge is relevant to problem solution (Havelock, 1969) (Handler, 1969) (Roling, 1973) (Hathaway, 1977) (Williams, 1978), (5) the assumption of technology transfer rather than an interactive communication process resulting in adaptive, intermediate or improved indigenous technology (Schumacher, 1973) (O'Kelley, 1977) (Gideonse, 1969) (Roling, 1973), (6) heavy responsibility placed on "linkers" without also placing responsibilities on those to be linked (Guba and Clark, 1975) (Gideonse, 1969) (Rogers and Jain, 1969), (7) dependence on "trickle-down" communication and lack of concern with the distribution effects of this type of technology adoption (Roling and Chege, 1976) (McNamara, 1977a) (Williams, 1978) (Ruttan, 1977) (Darling, 1977), (8) and probably most important, is the dissatisfaction with the effectiveness of many programs based on present information-communication systems models. (Schumacher, 1973) (Wharton, 1977) (Cummings, 1977) (McNamara, 1977, a and b) (Williams, 1978) (Darling, 1977)

It is only in the last two decades that emphasis has been placed on the systematic study and conceptualization of knowledge production and utilization information systems. Some of the more recent research, conceptualization and "model" building appears to counter some of the criticisms of past systems. No one believes he/she has developed the system. One such "information system" is briefly described here. It draws heavily on the work of many scholars, especially Havelock (1969) (1971) (1974), Guba (1970) (1974) and Clark (1975), Gideonse (1968), Rothman (1974), Kiehl (1970) and rural sociologists Lionberger (1976), Coughenour (1976), Rogers (Rogers and Jain, 1969) (Rogers and Shoemaker, 1971) and Roling (1973) (Roling and Chege, 1976). It may be of interest to note that those rural sociologists involved came out of a technology, adoption-diffusion background.

What follows is a brief discussion of what we have termed a paradigm which describes six categories of interrelated functions, activities and processes which are believed to be distinct enough to merit separate (stage or step) treatment, at least for heuristic purposes. In the basic monograph presenting this paradigm* each stage is described more completely, and specific functions, activities, processes and products are described. A brief description will have to suffice here.

The six stages are thought to represent different sets of activities with different outputs and require different skills for the successful

*Peter M. Meehan and George M. Beal, Knowledge Production and Utilization: A General Model - Third Approximation, Sociology Report No. 138, Department of Sociology and Anthropology, Iowa State University, Ames, Iowa, 1977.

carrying out of the processes. The specialized activities are thought to represent elements of the knowledge-production-utilization structures which must be permeated by continual communication if each relevant stage is to contribute fully to the task of generating knowledge and making it functional and useful.

Although the ultimate user, in the product-adoption/utilization stage, is the ultimate target of communication and behavior change, actors in each stage must meet the needs of users in other stages (Gideonse, 1969) if the needs of the ultimate users are to be fulfilled. Each of the stages between research and adoption/utilization is regarded as knowledge production and utilization unit in itself. In each stage (as specified in the more detailed description of the paradigm) the actors are seen as beginning by identifying specific user needs, planning and producing outputs according to those needs, and packaging outputs to appeal to the specified clients (Gideonse, 1969).

The term product is used often in this description. It is used to apply to a broad range of phenomena including hardware, material and software "products"; e.g. a research report, an information search package, a brochure, a radio program, a feedback procedure, a training module, a family planning campaign, a newly created advisory committee, an interorganizational coordination council with negotiated authority.

A brief description of the six stages follows.

1. Scientific knowledge production. Scientists, using the scientific method, produce knowledge in the form of verified statements of relationships between and among variables. Scientific knowledge is produced primarily by carrying out basic and applied research. Though the distinction made between basic and applied research is not always clear, they

can be seen as semi-autonomous but in many cases complementary activities which often must be interrelated or linked to provide information related to user needs. Basic research is often seen as oriented toward the production of knowledge for knowledge or discipline sake, while applied research is seen as producing or applying knowledge for solution of "real world" problems. Both types of knowledge may be needed to provide full or partial information to define or suggest possible solutions for user problems or for the development of technology.

I

KNOWLEDGE-PRODUCTION

Basic Research (BR)	Applied Research (AR)
1. depict problem	1. identify user needs
2. review research	2. depict problem
3. relate variables	3. review research
4. conceptualize problem	4. relate variables
5. test hypotheses	5. conceptualize problem
6. conclude from tests	6. test hypotheses
7. package results	7. conclude from tests
8. communicate results	8. package results
9. evaluate method	9. communicate results
	10. evaluate method

2. Knowledge-Management. The main outputs of the knowledge-production stage (previous stage) is a vast array of articles, reports, papers, monographs and books presenting research findings. If this knowledge is to be effectively utilized it must be monitored, screened, indexed,

catalogued, packaged and stored in a form which is readily retrievable at access points for functional search, use and dissemination. These activities may be designated as knowledge-management.

II

KNOWLEDGE-MANAGEMENT

1. identify user needs
2. monitor/screen research
3. catalogue
4. package
5. store
6. disseminate
7. evaluate operations

3. Knowledge-Translation. Knowledge-translation involves the synthesis and conversion of scientific research findings into information useful to product-developers who attempt to formulate solutions to practical problems. This stage may be characterized as one of the specific "meeting points" of abstract, scientific knowledge with the practical knowledge and problem definitions of clients. Effective "meeting" usually takes place through the efforts of highly-skilled translators or linkers with a "dual understanding" of the scientific and practical conception of the same problem--possessing the skills to code and recode back and forth between the clients formulation of a problem and relevant descriptors of available scientific knowledge. Scientific research is synthesized, generalized and operationalized to bear on the problems of clients and alternative products which may aid in problem solution. The outputs

from this stage may be papers, reports, presentations or consultation containing guidelines and information highly relevant for product development.

III

KNOWLEDGE-TRANSLATION

1. identify user needs
2. recode user problem
3. review research
4. synthesize/generalize research
5. recode generalizations
6. operationalize
7. package
8. dissemimte
9. evaluate operations

4. Product Development. At the product development stage translated (synthesized, generalized and operationalized) scientific knowledge is combined with knowledge of user needs (existing or created) and "products" are developed which are judged will have the potential of meeting these needs. There are variations in the orientations to product development: on the one hand there is emphasis on discovering needs and wants of target audiences (often involving disseminators and linkers in this process) and developing goods and services to meet these needs; on the other hand, the product may be first developed then its use is "promoted."

Solutions ("products") may take the form of social or material technologies--software or hardware.

IV

PRODUCT-DEVELOPMENT

1. identify user needs
2. formulate problem
   a. review research
   b. investigate user-system
   c. relate variables
3. invent solution
   a. draft performance/appeal specifications
   b. determine general function
   c. invent/design alternative solutions
   d. analyze/assess solutions
   e. select optimal solution
   f. design prototype
   g. review prototype
4. fabricate prototype solution
5. test, re-test prototype
6. fabricate marketable solution
7. package solution
8. transfer to disseminators
9. evaluate operations

5. Product-Dissemination. Once potential solutions to user needs or problems (existing or created) are developed, dissemination to clients or users is undertaken.

Activities at this stage usually include understanding the product and its uses, designing dissemination and communication strategy, distribution of the product, adaptation and installation of products, and monitoring product performance.

V

PRODUCT-DISSEMINATION

1. identify user needs
2. communicate needs to developer
3. assist product-development
4. understand solution
5. design dissemination/ distribution strategy
6. communicate product messages
   - advertise
   - publicize
   - promote
   - demonstrate
   - consult
   - counsel
   - inform
   - sell
7. initiate distribution
8. adapt/install product
9. monitor product performance
   - service
   - repair
   - resell
   - replace
10. evaluate operations

6. Product-Adoption/Utilization. Product-adoption/utilization is the process by which users, discover and diagnose problems, locate solutions, try-test solutions, adopt solutions and assimilate solutions into their existing systems in a manner to secure effective utilization of the solution.

VI

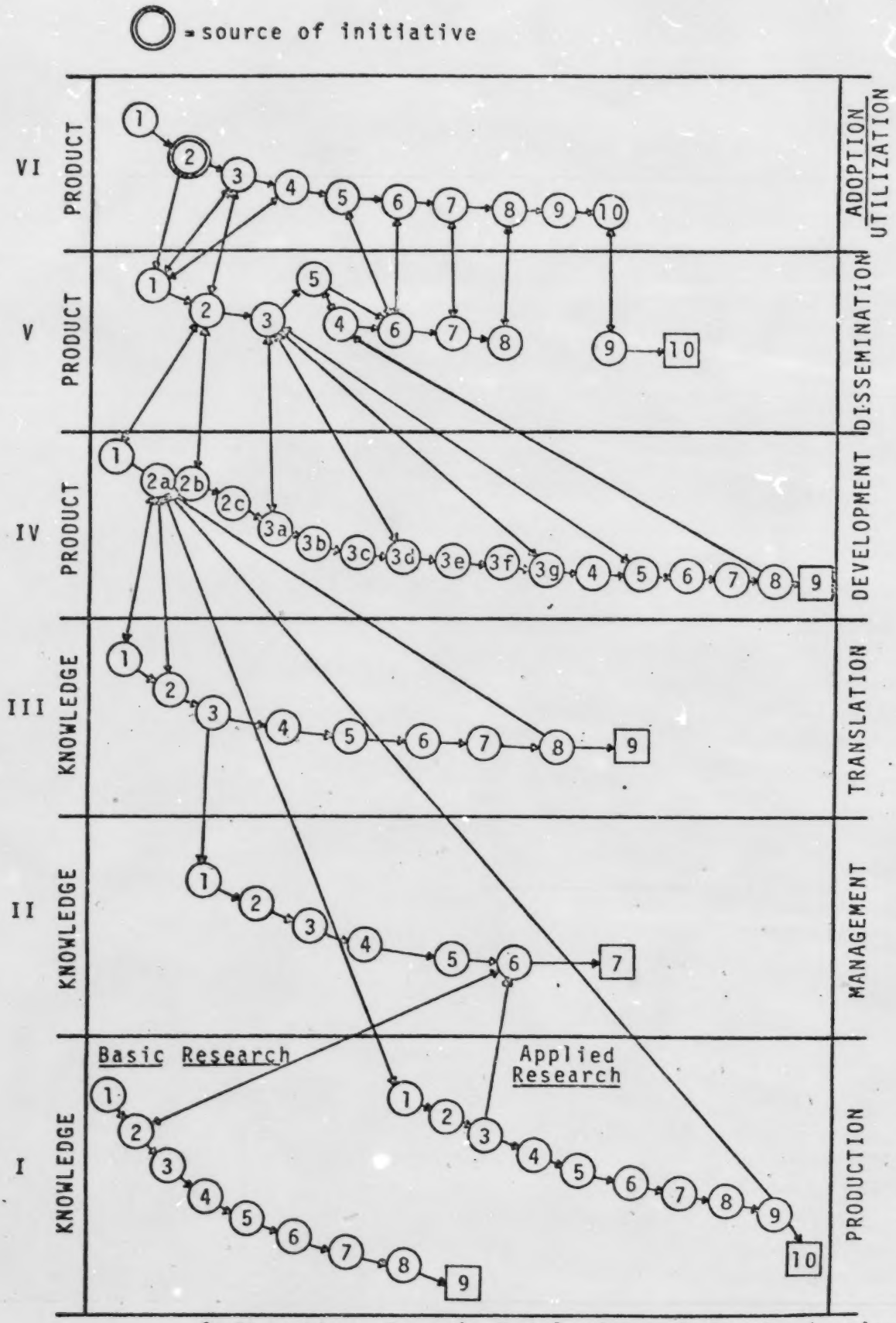
PRODUCT-ADOPTION/UTILIZATION

1. live with current needs
2. discover problem
3. diagnose problem
4. search for solution
5. evince interest in solution
6. try-test
7. adopt (or not adopt) solution
8. adopt/install solution
9. institutionalize solution
10. evaluate solution-maintain/ repair/replace

In some cases solutions to user needs or problems may already be available. The model argues for this situation setting off an interactive communication process that will continue through the previously discussed stages until knowledge sufficient to solve the problem is found or generated and the knowledge is transformed into a solution which is packaged and communicated to relevant linkers until the ultimate user can test, adapt and incorporate it into his situation for effective utilization. Thus, the paradigm may have the appearance of being one-way, linear--this is not necessarily true.

To further illustrate this point, a hypothetical example is presented. See the flow diagram on the next page labeled, "An Iterative, Dynamic Model of Knowledge-Production-and-Utilization in Agriculture."

The source of initiative for this particular path of utilization is the farmer in Stage VI who lives with his/her current needs (Stage VI, step 1) for fertilizers, pesticides, on and then discovers a problem (Stage VI, step 2). The problem is that current pesticides do not control a certain insect; as a result the corn-yield has been reduced significantly. The farmer and a technical field representative of a pesticide firm discuss the problem and they identify the farmer's need (Stage V, step 1). Farmer and representative then jointly diagnose the problem (Stage VI, step 3). The field representative (perhaps with an extension agent) communicates this need to a product-developer (Stage V, step 2) in a pesticide firm who thereby identifies the problem (Stage IV, step 1) and sets out to formulate the problem by means of a research review of corn pesticides and further investigation of the social and physical environmental problems of the farmer (Stage IV, step 2a and b). In doing so, the developer contacts a knowledge-translator to generate a synthesized, generalized, and operationalized packet of knowledge on the corn pest problem (Stage III, steps 1-8). Much of this knowledge is received from knowledge-management services through designation of appropriate descriptors (Stage II, steps 1-6). However, certain questions remains unanswered and the developer calls upon applied social and physical scientists to conduct experiments which clarify the operation of variables causing the farmer's problem (Stage I, (AR) Steps 1-9). In their literature reviews (Stage I, (AR) Step 3), the applied researchers utilize basic scientific knowledge retrieved, catalogued, and stored by a nationwide agricultural information-management service similar to that described by Kiehl (1970) (Stage II, steps 1-6). This knowledge was gathered over time from basic research projects in chemistry, economics, sociology, entomology, and other sciences (Stage I (BR) steps 1-8).



An Iterative, Dynamic Model of Knowledge-Production-and-Utilization in Agriculture

The applied researcher reviews this research, conducts experiments in the laboratory and the field, and the packages, translates and communicates the results (Stage 1, (AR) steps 8 & 9) to the product-developer to assist in problem-formulation. With sufficient empirical and theoretical knowledge of relevant variables, the developer begins the extended process of invention (Stage IV, step 3 a-g). At this point (with sufficient knowledge produced and communicated to the developer), interaction on the knowledge-production-and-utilization chain shifts decidedly to product-development, dissemination, and adoption/utilization (Stages IV-VII).

During invention, extension agents and field representatives assist wherever necessary in the drafting of performance and appeal specifications (Stage IV, step 3a), analysis and assessment (Stage IV, step 3d), and final review (Stage IV, step 3g). Disseminators as well as a sample of potential users further assist in field-testing (Stage IV, step 5). At the same time, agents and marketing specialists begin to plan alternative dissemination and distribution strategies according to place, price, product, and promotion variables (Stage V, step 5). When the product if finally deemed market-ready, it is fabricated (Stage IV, step 6), packaged with instructions and an appealing appearance (Stage IV, Step 7), and transferred to disseminators (Stage IV, step 8). Agents and salesmen study and learn about the use of the product until they understand the product (Stage V, Step 4): and, if necessary, they revise and implement the previously-designed dissemination/distribution strategy. Implementation occurs when product-messages are communicated to farmers through advertising, promotions, demonstrations, consultation, and selling (Stage V, step 6). This is likely to involve a variety of personal and impersonal contacts with farmers over an extended period of time. Disseminators may encourage try-tests or even include

free try-tests of the product in their dissemination/demonstration package (Stage VI, step 6). Farmers begin to purchase the new pesticide through conveniently-located sales points in the distribution channels (Stage V, step 7). Agents and salesmen assist farmers in the final adaptation and installation of the pesticide in their particular farming systems (Stage V, step 8 and Stage VI, step 8). Based on continued need and satisfactory product-performance, the new pesticide is repurchased and finally institutionalized by farmers over time (Stage 6, step 9). Farmers evaluate the product while agents and salesmen monitor its performance and action is taken by disseminators and users over the years to improve and perhaps eventually replace the pesticide with a better one (Stage V, step 9 and Stage 6, step 10).

An entire cycle of knowledge-production-and-utilization has been completed to illustrate the possible interaction of steps and stages on the utilization chain. In this case, initiative came from the client; was channeled through dissemination, development, translation, management, and production stages; and then came back to the client in the form of a solution to the original problem--a corn pesticide.

A Final Note

In brief summary, there are a number of ideas inherent in the paradigm that appear to be important.

The concept of knowledge production and utilization rather than research is used. This allows for the explicit recognition that there are other types of knowledge in addition to scientific research knowledge developed and written by scientists that can make a contribution to problem solution. It recognizes that relevant knowledge can (and in some cases must) be

provided by many people involved in the knowledge production and utilization process, often including linkers, product developers, disseminators and ultimate users.

There is recognition that the paradigm is not necessarily linear--does not assume a one way flow from basic research to the ultimate user. It recognized that that initiative and initiation of the process can start and/or occur at any stage in the paradigm. There is the recognition that the paradigm is iterative in character and that knowledge and communication moves back and forth from one stage to the next, rather than a smooth flow from the beginning to the end of a utilization chain--the process is often marked with repetition and recurring action.

It allows for collaborative knowledge production and utilizaton. It allows for movement away from dependency relations. Thus, there should be a facilitation of the development of intermediate technology, appropriate technology, selective technology and adaptive research and development, and trials.

It calls not only for a revised conceptualization, but for new roles and responsibilities and for some change in philosophy.

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